DOCUMENT RESUME

ED 374 306 CE 067 244

TITLE	Reading Charts and Graphs. Pipefitter.
INSTITUTION	Associated Builders and Contractors, Inc., Baton Rouge, LA. Pelican Chapter.; East Baton Rouge Parish School Board, La.; Greater Baton Rouge Chamber of Commerce, LA.
SPONS AGENCY	Office of Vocational and Adult Education (ED), Washington, DC. National Workplace Literacy Program.
PUB DATE	[92]
CONTRACT	V198A10155
NOTE	52p.; For documents related to this project, see CE 067 219-251. For companion manual, see CE 067 246.
PUB TYPE	Guides - Classroom Use - Instructional Materials (For Learner) (051) -- Tests/Evaluation Instruments (160)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	Adult Basic Education; Adult Literacy; Basic Skills; Behavioral Objectives; Building Trades; *Charts; Competency Based Education; *Graphs; Individualized Instruction; Learning Activities; Lesson Plans; *Literacy Education; Mathematics Instruction; Mathematics Skills; *Plumbing; *Problem Solving; *Tables (Data); Technical Education; Trade and Industrial Education; Word Problems (Mathematics)
IDENTIFIERS	*ABCs of Construction Project; *Pipe Fitters; Workplace Literacy

ABSTRACT

Developed by the ABCs of Construction National Workplace Literacy Project, these curriculum materials for the occupational area of pipefitting contain a lesson that deals with reading charts and graphs. The lesson consists of an objective, instruction, and seven exercises. Three types of problems are provided in each exercise: "try it," "apply it," and "go with it." The objective for the lesson is for the student to learn to locate and apply information from a table. (YLB)

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ED 374 306

TECHNICAL DEVELOPMENT CENTER

Reading
Charts and Graphs

PIPEFITTER

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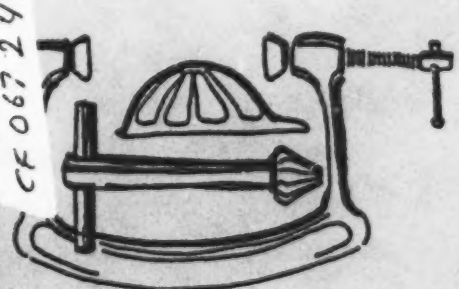

Associated Builders & Contractors, Inc.
EBR Adult & Continuing Education

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ABC's of Construction

National Demonstration Project in Workforce Literacy

The ABC's of Construction Project was funded in 1991 by the U.S. Department of Education as a grantee through the National Workplace Literacy Program (PR #198A10155). The program provided basic skills instruction to industrial construction workers employed by companies which are members of the Pelican Chapter of Associated Builders and Contractors (ABC). Located in Baton Rouge, Louisiana, ABC provides training to employees of over 60 member companies who perform contract work in the 58 petrochemical facilities located along the Mississippi River between Baton Rouge and New Orleans.

The grantee, the Adult Education Department of East Baton Rouge School Board, performed a comprehensive literacy task analysis of the apprenticeship training program for millwrights, pipefitters, electricians, instrumentation techs, and welders involved in the ABC training program. Over 20 modules of original, contextual curriculum were developed to teach the reading and math skills required for success in the craft training program.

Materials developed for instruction incorporated cognitive strategies for learning basic skills in the context of the craft and safety knowledge demanded by the industrial construction workplace. Instruction was written for a competency-based, open-entry/open-exit, individualized adult learning program that operated at the ABC training center in the evenings after work-hours.

ORGANIZING INFORMATION
WITH CHARTS AND TABLES
PIPEFITTING

OBJECTIVE

You will learn to locate and apply information from a table.

INSTRUCTION

The TRA Construction Company had a problem. Their workers were capable. But the company never finished a job on time. The owners called in an efficiency expert. The expert found the problem. The company did not handle its tools and materials well. There seemed to be no system to how things were stored. Workers spent more time looking for tools and materials than using them.

There was a solution. The company needed an organizational plan. They set up a room for tools. They set up another one for supplies. Everything was put on shelves, in boxes, or in stacks. Some materials, such as pipes, were organized by size. Some, such as power or hand tools, were organized by use. Other things were organized in other ways according to different features. The following chart shows you how they organized pipe by size, amount and location of the stacks.

TRA CONSTRUCTION PIPE STACKS

SIZE	Stainless steel pipe	Galvanized Pipe	Carbon Steel Pipe
3 inch	2000 ft	895 ft	1980 ft
4 inch	10,000 ft	989 ft	788 ft
6 inch	6500 ft	1033 ft	4500 ft
12 inch	8721 ft	9045 ft	2345 ft

Workers learned the system. They could go to any shelf, box, or stack and find what they needed. They knew where to look.

The key to organizing is grouping tools and materials according to a certain feature. Sometimes information is also easier to understand if it is grouped by a certain feature. Tables (also called charts) show how information is sorted by one or more features. Tables organize information into rows and columns. A row runs horizontally across the page (left to right). Columns run vertically down the page (top to bottom). Headings or labels tell what is in rows or columns. The following chart is marked to show you these features. Tables help you find what you need just as organizing materials helps you find what you want.

labels

TRA CONSTRUCTION PIPE STACKS

↓Column

SIZE	Stainless steel pipe	Galvanized Pipe	Carbon Steel Pipe
3 inch	2000 ft	895 ft	1980 ft
4 inch	10,000 ft	989 ft	788 ft
6 inch	6500 ft	1033 ft	4500 ft
12 inch	8721 ft	9045 ft	2345 ft

← Row

The title of this chart is TRA CONSTRUCTION PIPE STACKS. Materials are arranged by sizes--3,4,6, and 12-inch pipe. This identifies what is in each row. The labels across the top identify what is in the columns--stainless steel, galvanized, and carbon steel pipe. To use the chart, you find the size of pipe on the left. You find the kind of pipe at the top. You look for the place where that row and column meets. This tells you the amount of that size and kind of pipe in the stacks.

For example, a worker might want to know where to find 6 inch galvanized pipe. This chart also shows the layout of the stacks. The worker looks down the sizes to find 6-inch. She looks across the top and finds galvanized pipe. She concludes that this kind and size of pipe is in the middle column of stacks. It is in the third stack in that row.

The organization of charts allows them to be used in many ways. A supervisor may want a total of all 12-inch pipe of a certain size, no matter what kind. He locates the row for 12-inch pipe and totals all the numbers in that row. The chart below is marked to show you what numbers would be added in order to find the total.

TRA CONSTRUCTION PIPE STACKS

SIZE	Stainless steel pipe	Galvanized Pipe	Carbon Steel Pipe
3 inch	2000 ft	895 ft	1980 ft
4 inch	10,000 ft	989 ft	788 ft
6 inch	6500 ft	1033 ft	4500 ft
12 inch	**8721 ft**	**9045 ft**	**2345 ft**

total 12 inch pipe

You might also want to find out how much carbon steel pipe is on hand. You would locate the column for carbon steel pipe. You would total the numbers in that column. The following chart is marked to show you what numbers would be added in order to find the total.

TRA CONSTRUCTION PIPE STACKS total Carbon Steel pipe

SIZE	Stainless steel pipe	Galvanized Pipe	Carbon Steel Pipe
3 inch	2000 ft	895 ft	**1980 ft**
4 inch	10,000 ft	989 ft	**788 ft**
6 inch	6500 ft	1033 ft	**4500 ft**
12 inch	8721 ft	9045 ft	**2345 ft**

Tables are usually part of written information. They organize many details for easy use. In some ways, reading a table is much like reading a paragraph. Tables have main ideas. Tables include many details. You can draw conclusions about the information in them. The headings form key words to help you find the information you need. You must choose information you need from that which is not useful at that time.

The following steps are used in reading a table.

1. READ THE TITLE OF THE TABLE. This tells you the table's subject or general content. Some tables are not identified by a title. Then, you look at the contents and headings of the table. This helps you determine the main idea of the table for yourself.

2. LOOK AT THE LABELS OR HEADINGS. These tell you the items being compared and the features used to compare them. Headings form key words. These words help you choose which column or row you need to find information.

3. DETERMINE YOUR PURPOSE FOR READING THE TABLE. Questions on the job often require you to refer to a table. Thus, tables are used most often to locate specific answers.

4. READ ANY ACCOMPANYING WRITTEN DESCRIPTIONS. Written descriptions provide the context for understanding the table. The description may highlight or clarify information in the table.

5. RE-READ THE DESCRIPTION AND LABELS TO FIND INFORMATION. Tables sometime include information in abbreviated form. You may have to decide how features fit together. You may need to read and reread. This helps you make decisions about what the information means.

Re-examine the steps in reading a table using the following chart as an example:

TAKE-OFF CHARTS

Thread make-up varies with the nominal size of the pipe. Information concerning the dimensions of fittings is available from the manufacturer of fittings. These dimensions are not standard. Table 2 is an example of a make up chart. Notice that it gives important information that enables the pipefitter to figure lengths. Methods of figuring cut lengths will be discussed in the next section of the module.

Dimensions for Couplings	
Nom. Size	Length
1/2	1-5/16
3/4	1-1/2
1	1-11/16
1-1/2	2-1/8
2	2-1/2

Table 2

1. READ THE TITLE OF THE TABLE. The title of Table 2 is Dimensions for Couplings. It appears at the top of the chart.

2. LOOK AT THE LABELS OR HEADINGS. Table 2 has two headings: Nom. Size, Length. Circles show you where they are. Your experience and/or the reading tells you that Nom. Size is an abbreviation for Nominal Size in pipe. Thus, this table compare two features: pipe size and coupling length.

3. DETERMINE YOUR PURPOSE FOR READING THE TABLE. If you are a pipefitter, you use this chart to look up sizes for various sizes of pipe.

4. READ ANY ACCOMPANYING WRITTEN DESCRIPTIONS. Your reading tells you that these sizes are not standard. Different manufacturers size their pipes differently. This chart tells you the make-up for specific materials.

5. RE-READ THE DESCRIPTION AND LABELS TO FIND INFORMATION. Imagine you are using pipe with a nominal size of 1 1/2 inch. You want to know what length coupling you need. You find the heading for nominal size and look down the column until you find the size 1 1/2. Then you look across the row to find the coupling length you need. In this case, the length would be 2 1/8. What if the pipe had a nominal size of 1? You would look down the column until you saw 1. Then you would look across. Your answer would be 1 11/16. Shading on the following schedule shows you how to use this chart.

Charts provide basic units of information. You may have to take this information and do something with it to find the answer you need. For instance, a chart may tell you the weight of one pipe. But you want the weight of several pipes. Thus, you multiply the chart weight for one pipe times the number of pipes you have. For instance, look again to Table 2 in the example above. Imagine you are fitting pipe. You need to know the make-up for two ends of a 3/4 inch pipe. How would you use the chart? You look down the column for nominal size until you find 3/4. You look across and find the length you need is 1 1/2. But this is not your answer. You need to know the amount for 2 ends. So you multiply that amount (1 1/2) times 2. Your answer is 3.

EXERCISES #1

Mike is a new worker. He got a load of different sizes of pipe. Mike must stack it. He reviews the following information from his ABC manual.

STACKING

Stack ductile iron pipe on timbers or elevated concrete supports to keep the bottom layer off the ground. Some companies are using large styrofoam blocks for stacking pipe. For the sake of convenience, stack the same sizes of pipe together.

Alternate the layers of pipe by placing bell end on top of spigot end in successive layers. Be sure to place timbers between layers. Chock the ends of each layer to prevent movement.

For safety, follow the recommendations shown in Figure 8 that govern the number of layers high that various sizes of pipe may be stacked.

PIPE SIZE (inches)	NUMBER OF TIERS	PIPE SIZE (inches)	NUMBER OF TIERS
3	18	18	6
4	16	20	6
6	13	24	5
8	11	30	4
10	10	36	4
12	9	42	3
14	8	48	3
16	7	54	3

Figure 8 -- Stacking Pipe

TRY IT!

1. Where is the title of the chart?

_____

2. What is the title of the chart?

_____

3. List the headings.

_____

_____

_____

4. What is unusual about the headings?

_____

_____

5. Why do you think this is so?

_____

6. How will this affect the way you will use the chart?

_____

_____

APPLY IT!

1. Mike realizes he needs _____ in order to stack the pipe.

A. sheets of plywood
B. large styrofoam blocks
C. sawhorses
D. all of the above

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) Where is the answer to this question? _____

(d) Identify the information you used to answer the question.

_____

_____

2. Mike is ready to start. What is the best way to stack the pipe?

A. According to the manufacturer's recommendations.
B. In three stacks: large, medium, and small pipes.
C. Put one of each size together to form matched sets of pipe.
D. According to pipe size with all pipes of certain inch size together.

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) Where is the answer to this question? _____

(d) Identify the information you used to answer the question.

_____

_____

3. Mike has 6-inch pipe. How many tiers or levels can he use?

A. 16
B. 13
C. 18
D. 20

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

4. Mike is stacking large pipe. He has 42, 48, and 54 inch pipe. In that order, how many tiers can he have?

A. 9, 8, and 7 tiers
B. no more than 7 tiers in each
C. 3 tiers for each size
D. 3 or 4 tiers

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

5. The field supervisor is checking Mike's work. The supervisor finds 6 layers of 16 inch pipe. He sees 11 tiers of 8-inch pipe. He sees 4 layers of 42-inch pipe. Should the supervisor approve Mike's work?

A. No, Mike should have only 3 layers of 42-inch pipe.
B. No, Mike should have 8 layers of 8-inch pipe and 10 layers of 16 inch pipe.
C. No, none of Mike's stacks are correct.
D. Yes, Mike is correct.

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

GO WITH IT!

Look at the information again. List any five facts.

EXAMPLE: Both 30 inch and 35 inch pipe should be stacked no higher that 4 tiers.

EXERCISE #2

Mike has a new assignment. He must stack cast-iron pipe. Mike again refers to his ABC manual. He finds the following section and chart:

CAST IRON PIPE

For years, cast iron pipe was the standard material used in water lines. Ductile iron is gradually replacing cast iron in certain applications, but cast iron pipe is far from obsolete. Cast iron pipe offers good resistance to corrosion and is highly durable.

Since most of the material written about ductile iron pipe in this module applies to cast iron pipe, this section of the module concentrates on the differences between cast iron pipe and ductile iron pipe. These differences result mainly from the metallurgical differences between the two metals. Cast iron pipe uses the same types of joints, requires the same types of restraint, and is handled the same as ductile iron pipe.

Structure

Since gray cast iron is not treated with magnesium during production, it is more brittle than ductile iron. This is due to the way the carbon aligns itself within the metal. Therefore, cast iron pipe is not able to withstand the same crushing loads that ductile iron can take.

Weight and Sizes

Cast iron pipe is heavier than ductile iron pipe. It is available in nominal sizes 3"-48" and in thicknesses classes 22-28. The higher the thickness class number, the thicker the walls of the pipe.

Stacking

Cast iron pipe is stacked the same as ductile iron pipe. The only difference lies in the height of the layers. Figure 29 shows the recommended number of layers for stacking various sizes of cast iron pipe.

PIPE SIZE (inches)	Number of Tiers		
	16 ft. length	18 ft. length	20 ft. length
3	18	18	18
4	16	16	16
6	13	13	--
8	11	11	--
10	9	9	--
12	8	8	8
14	7	7	7
16	7	6	6
18	6	6	5
20	5	5	4
24	4	4	3
30	3	2	2
36	3	--	2
42	2	--	2
48	2	--	1

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TRY IT!

1. Where is the title of the chart?

_____

2. What is the title of the chart?

_____

3. List the headings.

_____

4. What is unusual about the headings?

_____

5. How does that affect the way you use the chart?

_____

6. This chart tells the number of tiers for three things. What are those three things?

_____

_____

_____

APPLY IT!

1. Mike reads about cast-iron pipe. He must adjust how he loads and stacks the pipe. What adjustments should he make?

A. Mike must cover the pipe to prevent rust.
B. Mike must adjust his rigging because cast iron pipe weighs less than ductile iron pipe.
C. Cast iron cannot withstand as much weight. Mike must reduce the number of layers for some sizes of pipe.
D. Mike can stack cast-iron pipe in the same way as ductile iron pipe.

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

2. Mike gets a load of 20-inch pipe. Each is 16 feet long. Into how many layers should he stack the pipe?

A. 5
B. 4
C. 6
D. 7

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

3. Mike stacks a load of 18 foot, 12 inch pipe into 9 layers. His supervisor checks his work. What might his supervisor say?

A. "Good job."
B. "Your stack should be no more than 8 layers high."
C. "Your stack should be at least 10 layers high."
D. "Your stack should be no more than 6 layers high."

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

4. Mike has an order for 10 20-foot pipes. It is all 48 inch pipe. How many stacks should Mike have?

A. 5
B. 3
C. 1
D. 10

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

5. Mike must stack 6 16 foot, 36 inch pipes. How many stacks will he have?

A. 1
B. 2
C. 3
D. 6

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

GO WITH IT!

Look at the information again. List any five facts.

EXAMPLE: Cast iron pipe comes is available in thickness classes 22-28.

EXERCISE #3

Ed has a new job. He must cut and fit stainless steel pipe. Ed reviews the following table and information about pipe sizes.

SIZES

Stainless steel pipe is listed in inches by its nominal size. Nominal size is an approximation of the inside diameter. There are times when the nominal size of a pipe and its actual inside or outside diameter will differ greatly, but nominal size is always used to describe pipe.

WALL THICKNESS

The wall thickness of stainless steel pipe is described by schedule number. As schedule numbers get larger, pipe walls get thicker. Stainless steel pipe is commonly available in schedule 5S, 10S, 40S and 80S. Other schedules may be supplied on special request. It is important to remember that a schedule number only describes the wall thickness of a pipe of a given nominal size. Thus, 3/4 inch schedule 40S does not have the same wall thickness as 1 inch schedule 40S.

Table 1 shows standard pipe sizes and wall thicknesses for stainless steel pipe.

PIPE SIZE (inches)	O.D. of PIPE	NOMINAL THICKNESS FOR SCHEDULE--->			
		SCHED. 5S	SCHED. 10S	SCHED. 40S	SCHED. 80S
1/8	0.405	---	0.049	0.068	0.095
1/4	0.540	---	0.065	0.088	0.119
3/8	0.675	---	0.065	0.091	0.126
1/2	0.840	0.065	0.083	0.109	0.147
3/4	1.050	0.065	0.083	0.113	0.154
1	1.315	0.065	0.109	0.133	0.179
1 1\4	1.660	0.065	0.109	0.140	0.191
1 1\2	1.900	0.065	0.109	0.145	0.200
2	2.375	0.065	0.109	0.154	0.218
2 1\2	2.875	0.083	0.120	0.203	0.276
3	3.5	0.083	0.120	0.216	0.300
3 1/2	4.0	0.083	0.120	0.226	0.318
4	4.5	0.083	0.120	0.237	0.337
5	5.563	0.109	0.134	0.258	0.375
6	6.625	0.109	0.134	0.280	0.432
8	8.625	0.109	0.148	0.322	0.500
10	10.75	0.134	0.165	0.365	0.500
12	12.75	0.156	0.180	0.375	0.500

Table 1
Standard Pipe Sizes

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TRY IT!

1. Where is the title of the chart?

_____

2. What is the title of the chart?

_____

3. List the headings.

_____

4. What is unusual about the headings?

_____

5. How does that affect the way you use the chart?

_____

6. What five things could you determine for each nominal pipe size?

_____

_____

_____

_____

_____

APPLY IT!

1. Ed goes to work the next day. He overhears someone say that nominal size is about the same as the outside diameter. Ed thinks,

A. "Nominal size is about the same as the inside diameter."
B. "There's no difference between the outside diameter and the inside diameter."
C. "Nominal size refers to schedule numbers."
D. "I agree."

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

2. Ed is going to fit pipe. It has a nominal size of 3/8. He has a piece of pipe which is schedule 40S. He also has one of Schedule 80S. Ed thinks, "Both are 3/8 inch pipe. Therefore, they must be the same."What should you tell Ed?

A. Both schedules have the same nominal thickness.
B. Schedule 40S has a greater wall thickness than Schedule 80S.
C. Schedule 80S has a greater wall thickness than Schedule 40S.
D. The outside diameter of Schedule 80S is greater than that of Schedule 40S.

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

3. Ed has a co-worker who plays tricks on people. She has mixed up some pipes. Ed knows all the pipes are Schedule 5S. Ed checks the nominal thicknesses of the pipes. He finds them to be 0.109. The nominal pipe sizes could be _____.

A. 5,6,or 8
B. 1, 1 1/4, 1, 1/2, or 2
C. 1/2 only
D. 1/4 only

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

4. Ed is constructing some special insulation. It is for a system using 5 inch pipe. He needs to know the outside diameter. He finds it to be _____.

A. the same as the pipe size.
B. 6.625
C. 5 1/2
D. 5.563

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

5. Ed is repairing a piping system. He measures the outside of the pipe. He finds the diameter to be .675. What size pipe is it?

A. 1/4 inch
B. 1/2 inch
C. 3/8 inch
D. 1 inch

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

GO WITH IT!

Sometimes information in charts can be regrouped. This forms a different chart. Construct a chart showing all the nominal pipe sizes and their schedule numbers which have a nominal thickness of 0.109.
The first 2 have been done as an example.

Size	Schedule Number
5	5S
6	5S

EXERCISE #4

Jack is working with Lonnie. Lonnie is a new rigging operator. Jack wants Lonnie to follow safe working load procedures. He gives him the following table:

TABLE 1 RATED CAPACITIES

RATED CAPACITIES FOR 2-LEG & 3-LEG BRIDLE SLINGS
6 X 19 AND 6 X 37 CLASSIFICATION IMPROVED PLOW STEEL GRADE ROPE
WITH FIBER CORE (FC)

Rope		Rated Capacities, Tons (2,000 lb)											
		2-Leg Bridle Slings						3-Leg Bridle Slings					
Dia (Inches)	Constr	Vert 30 degree Horz 60 degree		45 degree Angle		Vert 60 degree Horz 30 degree		Vert 30 degree Horz 60 degree		45 degree Angle		Vert 60 degree Horz 30 degree	
		HT	MS	HT	MS	HT	MS	HT	MS	HT	MS	HT	MS
1/4	6 x 19	0.85	0.88	0.70	0.72	0.49	0.51	1.3	1.3	1.0	1.1	0.74	0.7
5/16	6 x 19	1.3	1.4	1.1	1.1	0.76	0.79	2.0	2.0	1.6	1.7	1.1	1.2
3/8	6 x 19	1.8	1.9	1.5	1.6	1.1	1.1	2.8	2.9	2.3	2.4	1.6	1.7
7/16	6 x 19	2.5	2.6	2.0	2.2	1.4	1.5	3.7	4.0	3.0	3.2	2.1	2.3
1/2	6 x 19	3.2	3.4	2.6	2.8	1.8	2.0	4.8	5.1	3.9	4.2	2.8	3.0
9/16	6 x 19	4.0	4.3	3.2	3.5	2.3	2.5	6.0	6.5	4.9	5.3	3.4	3.7
5/8	6 x 19	4.8	5.3	4.0	4.4	2.8	3.1	7.3	8.0	5.9	6.5	4.2	4.5
3/4	6 x 19	6.8	7.6	5.5	6.2	3.9	4.4	10.0	11.0	8.3	9.3	5.6	6.6
7/8	6 x 19	8.9	10.0	7.3	8.4	5.1	5.9	13.0	15.0	11.0	13.0	7.7	8.9
1	6 x 19	11.0	13.0	9.4	11.0	6.7	7.7	17.0	20.0	14.0	16.0	10.0	11.0
1 1/8	6 x 19	14.0	16.0	12.0	13.0	8.4	9.5	22.0	24.0	18.0	20.0	13.0	14.0
1 1/4	6 x 37	17.0	19.0	14.0	16.0	9.8	11.0	25.0	29.0	21.0	23.0	15.0	17.0
1 3/8	6 x 37	20.0	23.0	17.0	19.0	12.0	13.0	31.0	35.0	25.0	28.0	18.0	20.0
1 1/2	6 x 37	24.0	27.0	20.0	22.0	14.0	16.0	36.0	41.0	30.0	33.0	21.0	24.0
1 5/8	6 x 37	28.0	32.0	23.0	26.0	16.0	18.0	43.0	48.0	35.0	39.0	25.0	28.0
1 3/4	6 x 37	33.0	37.0	27.0	30.0	19.0	21.0	49.0	56.0	40.0	45.0	28.0	32.0
2	6 x 37	43.0	48.0	35.0	39.0	25.0	28.0	64.0	72.0	52.0	59.0	37.0	41.0

HT = Hand Tucked Splice.
MS = Mechanical Splice.

TRY IT!

1. Where is the title of the chart?

2. What is the title of the chart?

3. List the headings.

4. What is unusual about the headings?

5. Why do you think this is so?

6. How will this affect the way you will use the chart?

APPLY IT!

1. Lonnie is confused about the abbreviations on the table. What do the following abbreviations mean?

HT _____

MS _____

Vert _____

Horz _____

Dia _____

Constr _____

FC _____

lb _____

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

2. Lonnie is using 1 inch rope. He constructs a 2-leg bridle sling. It has a hand-tucked splice. It has a 45° angle. What will be the rated capacity?

A. 9.4
B. 11.0
C. 13.0
D. 6.7

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

3. Jack told Lonnie that the 2-leg bridle sling isn't strong enough. Lonnie wants to use a 1 inch rope. It will have a hand-tucked splice. How can he increase the lifting capacity?

A. He can't.
B. He can use a vertical angle of 60° and a horizontal angle of 30°.
C. He can use a vertical angle of 30° and a horizontal angel of 60°.
D. He can use a 3-leg bridle.

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

4. Lonnie has a 2-leg bridle sling. It is constructed of 1 1/2 inch rope. It has a mechanical splice. What is the range of capacity he can lift?

A. 24-16
B. 27-16
C. 20-13
D. 28-18

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

5. Lonnie constructed a 3-leg bridle sling. He made it of 1/2 inch rope. It has a hand tucked splice. He used 30° horizontal and 60° vertical angles. What is the rating capacity?

A. 2.8
B. 3.0
C. 3.7
D. 4.8

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

GO WITH IT!

For 5 different slings, construct a sentence which describes their construction and capacity.

EXAMPLE

A 1-inch 2-Leg bridle sling with a hand tucked splice and 45° angles will support 9.4 tons.

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

EXERCISE #5

Jose must load pipe. He wants to move it safely. He reviews the following to figure the pipe's weight:

/

DETERMINING THE WEIGHT OF PIPE

It is possible to determine the weight of pipe before lifting it. Every foot of pipe weighs a given amount, depending upon the wall thickness and nominal size of the pipe. Therefore, if you know the weight per foot and the total number of feet, the total weight of the lift can be determined by multiplication.

Look at Table 6. The information in this table refers to carbon steel pipe. The numbers in the far left column represent nominal pipe size in inches. The designations across the top represent wall thickness. To use the table, find the point at which the nominal size and wall thickness meet. The number at this point is the weight of one foot of pipe. To find the total weight, multiple the total number of feet by the weight per foot.

WALL THICKNESS - CARBON STEEL PIPE

NOMINAL PIPE SIZE IN INCHES	STD	XS	XSS	10	40	60	80	120	160
2	3.65	5.02	9.03		3.65		5.02		7.06
2.5	5.79	7.66	13.7		5.79		7.66		10.01
3	7.58	10.25	18.58		7.58		10.25		14.31
3.5	9.11	12.51	22.85		9.11		12.51		
4	10.79	14.98	27.54		10.79		14.98	18.98	22.52
6	18.97	28.57	53.16		18.97		28.57	36.42	45.34
8	28.55	43.39	72.42		28.55	35.66	43.39	60.69	74.71
10	40.48	54.74	104.1		40.48	54.74	64.40	89.27	115.7
12	49.56	65.42	125.5		53.56	73.22	88.57	125.5	160.3
14	54.57	72.09		36.71	63.37	85.01	106.1	150.8	139.2
16	62.58	82.77		42.05	82.77	107.5	136.6	192.4	245.2
18	70.59	93.45		47.39	104.8	138.2	170.8	244.1	308.6
20	78.60	104.1		52.73	123.1	166.5	208.9	296.4	379.1
22	86.61	114.8		58.07		197.4	250.8	353.6	451.1
24	94.62	125.5		63.41	171.2	238.3	296.5	429.5	542.1
26	102.6	136.2		85.73					
28	110.6	146.9		92.41					
30	118.7	157.5		99.08					
32	126.7	168.2		105.8	229.9				
34	134.7	178.9		112.4	244.6				
36	142.7	189.6		119.1	282.4				
42	166.7	221.6			330.4				

WEIGHT PER FOOT IN POUNDS

Table 6

TRY IT!

1. Where is the title of the chart?

_____

2. What is the title of the chart?

_____

3. Where are the labels for this chart? What are they?

_____

APPLY IT!

1. Jose must move 10 feet of 2 inch, schedule STD cast iron pipe. What is the weight of the pipe?

A. 3.65 lb.
B. 36.50 lb.
C. 365 lb.
D. Jose cannot determine the weight from this chart.

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

2. Jose's first load is 10 inch schedule 80 pipe. It is in 10 foot lengths. He wants to have no more than one ton in his load. What is the largest number of pipes he can carry?

A. one
B. three
C. five
D. nine

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

3. Jose's friends don't know that he's read about how to weigh pipe. They bet him lunch that the bigger the pipe size, the more it weighs. Jose says that some smaller pipes weigh more. Which two pipes could Jose use to win the bet?

A. 42 schedule 40 and 24 schedule 80
B. 36 schedule 40 and 24 schedule 60
C. 34 schedule 40 and 18 schedule 120
D. 36 schedule 40 and 18 schedule 160

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

4. Jose must rig a load of pipe. He has ten feet of 2 inch schedule 80 pipe. He also has 100 feet of 20 inch schedule 40 pipe. What is the total weight of the pipe?

A. 12360.2
B. 2125.5
C. 313.92
D. 128.12

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

5. Jose must move 10 feet of schedule XS 2.5 inch pipe. He must also move 10 feet of schedule 80 2.5 inch pipe. He wonders if he can use the same rigging. What is your advice?

A. No, Schedule 80 weighs more.
B. No, Schedule XS weighs more.
C. Yes, they weigh the same.

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

GO WITH IT!

Create a sentence which tells the classes of pipe for each of the following pipe sizes.

EXAMPLE

2-inch: 2-inch pipe comes in STD, XS, XSS, 40, 80, and 120 classes.

4 inch _____

_____

22 inch _____

_____

12 inch _____

_____

26 inch _____

_____

42 inch _____

_____

EXERCISE #6

Lynn has a new job. She will work with concrete pipe. She wants to prepare for the first day. She reviews the following information:

CONCRETE PIPE SIZES

The following table lists minimum required dimensions and wall thicknesses based on standards written by the American Society for Testing and Materials (ASTM). Since there may be variations among manufacturers, always consult the literature received from the specific manufacturer of the concrete pipe used on the project.

Diameters given for concrete pipe refer to inside diameters. This is a convention that is standard throughout the industry.

The weights-per-foot of the pipe listed are based on concrete that weighs 150 pounds per cubic foot. Since concrete varies in weight depending on how it is mixed, the weights given in the tables should be considered approximate.

TABLE 1

This table gives information about nonreinforced concrete culvert, storm drain, and sewer pipe with bell and spigot joints for sizes 4" through 24". Notice that there are three classes. The larger the class number, the thicker the walls.

ASTM C 14 – Nonreinforced Sewer and Culvert Pipe, Bell and Spigot Joint.

	CLASS 1		CLASS 2		CLASS 3	
Internal Diameter, inches	Minimum Wall Thickness, inches	Average Weight, pounds per foot	Minimum Wall Thickness, inches	Average Weight, pounds per foot	Minimum Wall Thickness, inches	Average Weight, pounds per foot
4	3/8	9.5	3/4	13	7/8	15
6	3/8	17	3/4	20	1	24
8	3/4	27	7/8	31	1 1/8	36
10	7/8	37	1	42	1 1/4	50
12	1	50	1 1/8	68	1 3/4	90
15	1 1/4	78	1 5/8	100	1 7/8	120
18	1 1/2	105	2	155	2 1/4	165
21	1 3/4	159	2 1/4	205	2 3/4	260
24	2 1/8	203	3	315	3 3/4	350

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TRY IT!

1. Where is the title of the chart?

_____

2. What is the title of the chart?

_____

3. List all the headings.

_____

_____

4. Why is INTERNAL DIAMETER INCHES only listed once?

_____

5. How will this affect the way you use this chart?

_____

APPLY IT!

1. Lynn's supervisor says they need pipe. It must have a 1-inch minimum wall thickness. What internal diameter of pipe might they use?

A. Class 1, 12 inch
B. Class 2, 10 inch
C. Class 3, 6 inch
D. all of the above

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

2. Lynn checks the outside diameter of some pipe. She finds it to be 8 inches. What is the average weight in pounds per foot?

A. 27
B. 31
C. 36
D. You cannot tell from this table.

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

3. Lynn must move some pipe. She has 10 feet of 18 inch pipe, Class 3. What is the weight of the pipe?

A. 165 lb
B. 1650 lb
C. 1550 lb
D. You cannot tell from this table.

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

4. Lynn has 12 inch pipe, Class 1. What is the outside diameter?

A. 12
B. 13
C. 14
D. You cannot tell from this chart.

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

5. Lynn has one foot of 18 inch pipe in all three classes. What is the total weight of the pipe?

A. 425 pounds
B. 325 pounds
C. 165 pounds
D. You cannot tell from this chart.

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

GO WITH IT!

Write three sentences which describes differences in class weights for the following pipe sizes.

EXAMPLE
Class 1 4 inch pipe weighs 9.5 pounds per foot.
Class 2 4 inch pipe weighs 13 pounds per foot.
Class 3 4 inch pipe weighs 15 pounds per foot.

6-inch pipe

_____

_____

_____

12-inch pipe

_____

_____

_____

18-inch pipe

_____

_____

_____

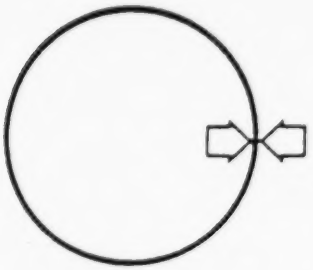
EXERCISE #7

Zeke uses cast iron pipe. His new job uses ductile iron pipe. He refers to the following on the job:

SIZES

Ductile iron pipe is available in nominal sizes ranging from 3" to 54" in 20' lengths. Wall thickness is described by standard class numbers. Class thickness ranges from 50 through 56. The larger the class number, the thicker the walls of the pipe. Figure 7 shows how ductile iron pipe is sized. Notice that there is considerable variation between nominal size and actual outside diameter.

AMERICAN Ductile Iron Pipe
ANSI/AWWA C150/A21.50
and
ANSI/AWWA C151/A21.51
Standard Thickness Classes



Size In.	Outside Diameter In.	STANDARD CLASSES – Wall Thicknesses in Inches*						
		50	51	52	53	54	55	56
3	3.96	—	.25	.28	.31	.34	.37	.40
4	4.80	—	.25	.29	.32	.35	.38	.41
6	6.90	.25	.28	.31	.34	.37	.40	.43
8	9.05	.27	.30	.33	.36	.39	.42	.45
10	11.10	.29	.32	.35	.38	.41	.44	.47
12	13.20	.31	.34	.37	.40	.43	.46	.49
14	15.30	.33	.36	.39	.42	.45	.48	.51
16	17.40	.34	.37	.40	.43	.46	.49	.52
18	19.50	.35	.38	.41	.44	.47	.50	.53
20	21.60	.36	.39	.42	.45	.48	.51	.54
24	25.80	.38	.41	.44	.47	.50	.53	.56
30	32.00	.39	.43	.47	.51	.55	.59	.63
36	38.30	.43	.48	.53	.58	.63	.68	.73
42	44.50	.47	.53	.59	.65	.71	.77	.83
48	50.80	.51	.58	.65	.72	.79	.86	.93
54	57.10	.57	.65	.73	.81	.89	.97	1.05

*These are standard thickness Classes as given in AWWA C150 and C151. AMERICAN can furnish any thickness in between these standard thicknesses if deemed economical for major projects. Some sizes of pipe can be furnished in thickness classes heavier than Class 56.

Courtesy American Ductile Iron Pipe
A Division of American Cast Iron Pipe Co

Fig. 7. Ductile iron pipe sizes

*BEST COPY AVAILABLE

TRY IT!

1. Where is the title of the chart?

_____

2. What is the title of the chart?

_____

3. List all the headings.

_____

_____

4. What three things does this chart tell you about a pipe?

_____

5. How will this affect the way you use this chart?

_____

APPLY IT!

1. Zeke must fit 14 inch pipe. What is the outside diameter of the pipe?

A. 15.30
B. 17.40
C. 14.25
D. You cannot tell from this chart

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

2. Zeke's supervisor asks him to get some 30 inch pipe. It must have a wall thickness of at least 1/2 inch (.50). Which classes of pipe could Zeke choose?

A. Class 50
B. Class 51
C. Class 52
D. Class 53

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

3. Zeke is working on a special project. It requires pipe with a wall thickness of exactly .40. He can choose any size pipe and class. What could he choose?

A. 3 inch, class 56
B. 6 inch, class 55
C. 12 inch, class 53
D. all of the above

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

4. One of Zeke's buddies is playing a trick on him. He tells him to get a 25 foot long, 30 inch pipe in schedule 50. Why won't Zeke be able to get that pipe?

A. 30 inch pipe doesn't come in schedule 50
B. You can't get 30 inch pipe.
C. Ductile iron pipe doesn't come in 25 foot lengths.
D. The joke's on Zeke's buddy. Zeke will have no problem finding that pipe.

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

5. Zeke gets an order for a load of pipe. He needs 10 feet of 5 inch class 55 pipe, 5 feet of 3 inch class 50 pipe, and 6 feet of 30 inch class 57 pipe. Why can't Zeke fill this order?

A. There is no five inch pipe.
B. There is no 3 inch class 50 pipe.
C. There is no class 57 pipe.
D. All of the above

(a) Is the answer to this question found in the table? _____

(b) How did you know?

_____

_____

(c) How did you find the answer?

_____

_____

(d) Identify the information you used to answer the question.

_____

_____

GO WITH IT!

Write a sentence which describes the size, outside and class for each of the following:

EXAMPLE: 3 inch, class 55

The outside diameter of a 3 inch pipe is 3.96 inches and the wall thickness is .37 inches.

1. 20 inch, class 50

_____

_____

2. 36 inch, class 56

_____

_____

3. 8 inch, class 51

_____

_____

4. 48 inch, class 53

_____

_____